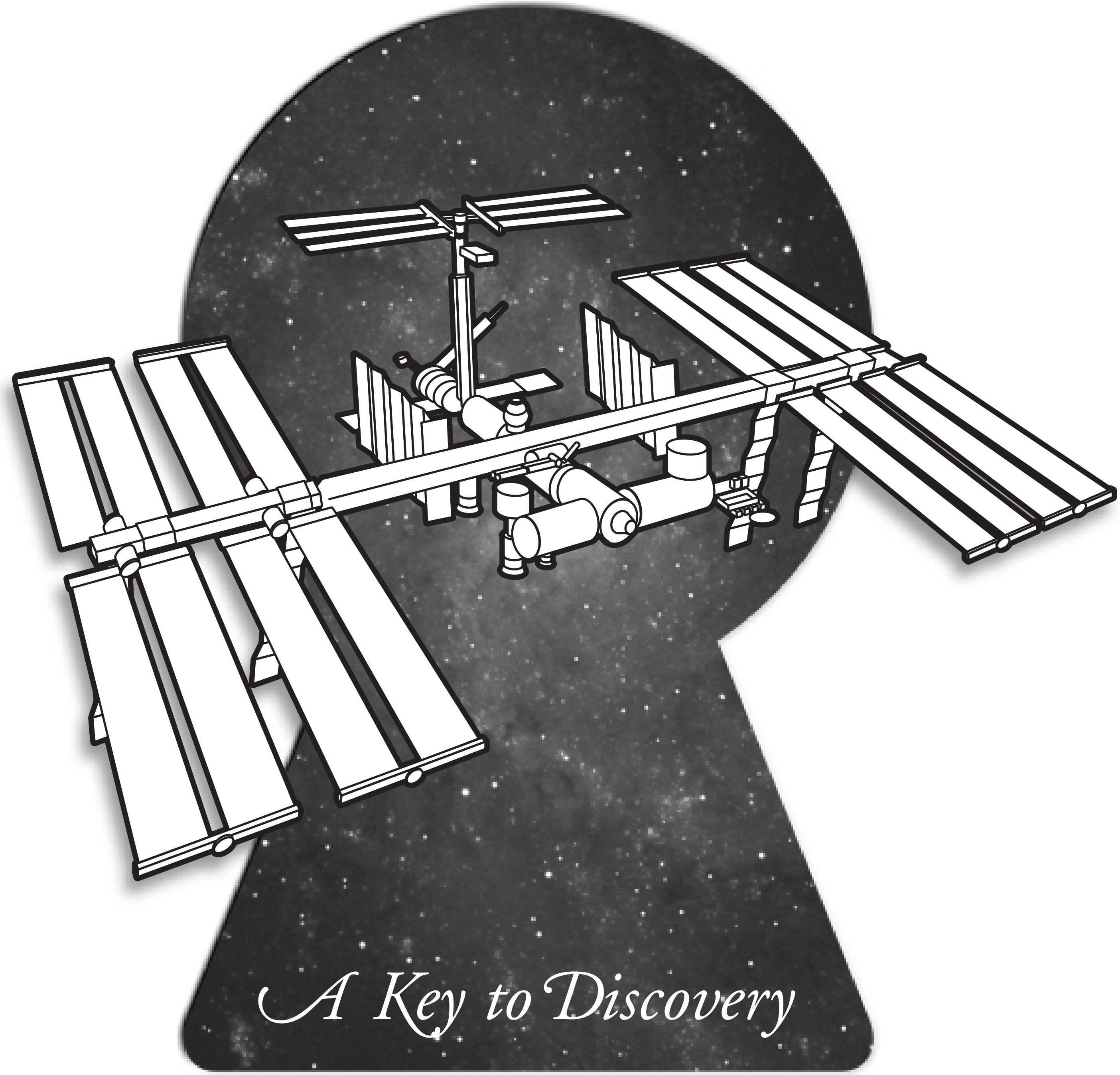


The International Space Station Fact Book

National Aeronautics and Space Administration

http://spaceflight.nasa.gov

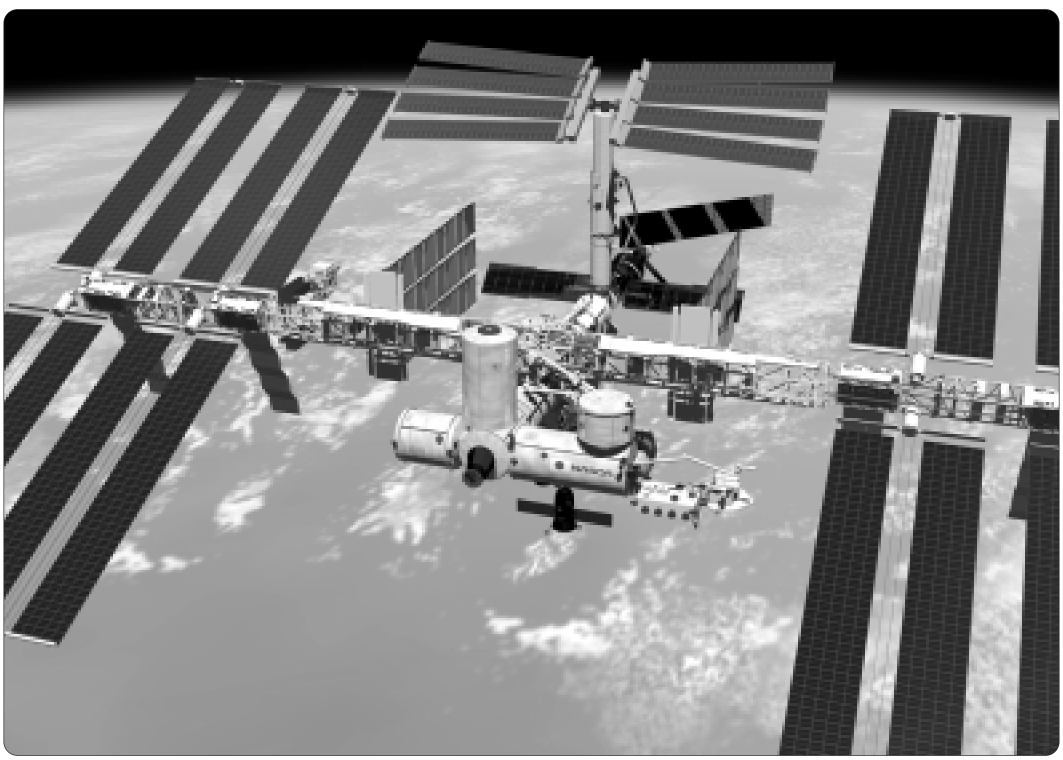
July 2001

The exciting thing is that we
don't *know what lies beyond*
the unopened door . . . and each
door will open to many more
doors . . . each answer leading
to many more questions . . .
that is discovery.

International Space Station
A Key to Discovery
NASA

Why the ISS? It's about life on Earth . . . and beyond!

Exploration	The International Space Station (ISS) is an exciting gateway to new frontiers in human space exploration, meeting the deep-seated need of men and women throughout history to explore the unknown, to understand their world and the universe, and to apply that knowledge for the benefit of all here on Earth.
Leadership	The ISS sustains U.S. leadership in exploration and use of outer space that has inspired a generation of Americans and people thoughout the world.
Research	The ISS is a unique world-class laboratory providing an international platform for advances in science and technology.
Business	The ISS provides a stunning opportunity to enhance U.S. economic competitiveness and create new commercial enterprises.
Education	The ISS serves as a virtual classroom in space to the benefit of educators and students alike.



This artist's concept shows the International Space Station when its assembly sequence is completed. The 1-million-pound station will have a pressurized volume equal to two jumbo jets and an acre of solar panels.

ISS Facts and Figures

The Station:

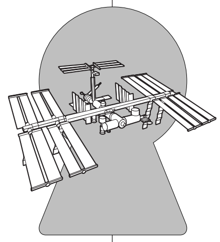
■ Wingspan Width:	356 feet (108.5 meters)
■ Length:	290 feet (88.4 meters)
■ Mass (weight):	About 1 million pounds (453,592 kilograms)
■ Operating Altitude:	220 nautical miles average (407 kilometers)
■ Inclination:	51.6 degrees to the Equator
■ Atmosphere inside:	14.7 psi (101.36 kilopascals) same as Earth
■ Pressurized Volume:	Approximately 43,000 cubic feet (1,218 m^3) in 6 laboratories
■ Crew Size:	3

American Expenditure Statistics Compared to NASA Budget

Proposed President's Fiscal Year 2002 Budget	Billions of Dollars
■ Human Space Flight	7.3
■ International Space Station	(2.1)
■ Space Shuttle	(3.3)
■ Other	(1.9)
■ Science, Aeronautics, and Technology	7.2
■ Inspector General	0.2
Total	**14.7**

American Consumer Expenditures*	
■ Tobacco products	66.0
■ Alcohol purchased for off-premise consumption	69.3
■ Clothing, accessories, and jewelry	397.2
■ New autos	97.3
■ Gasoline and oil	128.3
■ Airline	30.7
■ Recreation	534.9

* Source of information is the Department of Commerce Survey of Current Business, Personal Consumption Expenditures.



The International Space Station Fact Book

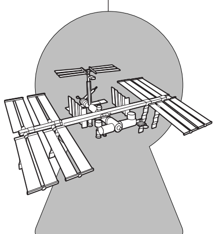
The ISS is an Earth-orbiting laboratory drawing upon the scientific and technological expertise of 16 nations: the United States, Canada, Japan, Russia, 11 member nations of the European Space Agency (ESA), and Brazil.

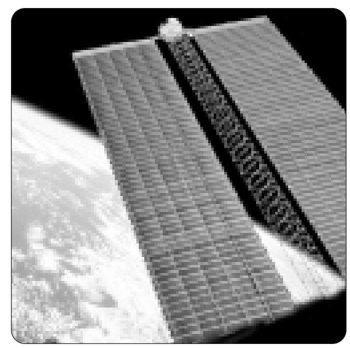
ISS research offers a new window on our world.

The pressurized living and working space aboard the completed ISS will be about the size of three average American homes. Its giant solar arrays will generate the electricity needed to power about 50 average American homes. An initial crew of three began living aboard the ISS in late 2000. Inside the ISS its weightless environment will be maintained at "shirt sleeve" temperatures with atmospheric pressures similar to what we have here on Earth.

Six main laboratories will house research facilities:

- Two U.S.—a laboratory module called "Destiny" and a Centrifuge Accommodations Module (CAM)
- One European Space Agency (ESA) laboratory named "Columbus"
- One Japanese Experiment Module named "Kibo"
- Two Russian Research Modules

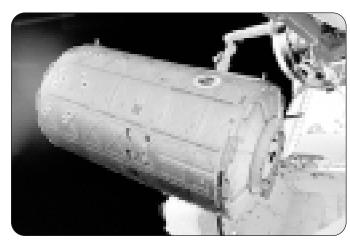




ISS solar arrays generate renewable power from the Sun.

The central girder, called the truss, will connect the modules and four giant solar arrays making the ISS larger than a football field. The Canadian-built Remote Manipulator System, a 55-foot robot arm and a grappling mechanism called the Special Purpose Dexterous Manipulator (SPDM), will move along the truss on a mobile base transporter to perform assembly and maintenance work.

External sites for mounting experiments intended for looking down at Earth and out into space or for direct exposure to space are provided at four locations on the truss structure, along with 10 on the Japanese Kibo Module's back porch and 4 on the ESA Columbus Module exposed facility. These external experiment sites vary as to the number of payloads that can be accommodated.



Delivery of Destiny, the U.S. Laboratory

A three-person Russian Soyuz capsule provides emergency crew return.

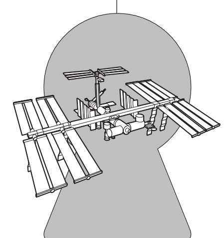
A variety of vehicles will be visiting the ISS to ferry crew and supplies to and from Earth. Crew exchanges will be accomplished with the Space Shuttle and Soyuz. Russian Progress spacecraft, Japanese H-II Transfer Vehicle, and Europe's Autonomous Transfer Vehicle (ATV) will provide resupply and reboost.

Progress to Date

The International Space Station and its crew of three are orbiting the Earth at an altitude of over 230 miles (372 kilometers) and at a speed exceeding 17,000 mph (27,358 km/h).

Operational Progress

- The first crew, Expedition One, opened the ISS for business in late 2000. Their principal job was attaching, checking out, and configuring the Station.
- Expedition Two is outfitting the Lab and began 18 experiments focused on radiation, bone loss, and changes in reflexes.
- With the successful installation of Quest, the Airlock, in July 2001, the ISS has completed its Phase II Assembly milestone and is now a fully functioning operational facility. Key operational systems activated and confirmed include the following:
  - Life-support systems needed to maintain a "shirt-sleeve" environment for the crew;
  - Power systems needed to generate, store, and distribute renewable electricity from the solar arrays;
  - Flight control systems needed to maintain a stable orbiting platform;
  - Voice systems needed to communicate among the orbiting modules and with ground control data systems for commanding and monitoring ISS health and status; and
  - Airlock and space suit systems needed to conduct spacewalks without the Space Shuttle present.
- Mission Control Center-Houston (MCC-H) has assumed responsibility from MCC-Moscow as the lead ISS Control Center.



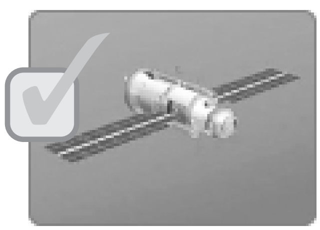
Development and Assembly Progress

- Each International Partner has made contributions to the ISS configuration onorbit:
  - Destiny, the U.S. Laboratory, the most complex and capable piece of the ISS;
  - Russia's Zvezda Service Module;
  - NASDA-developed Neutron Detector in the U.S. Lab, Kibo, Japan's Experiment Module and principal contribution, continues on schedule for a 2004 launch;
  - European Space Agency's data management equipment on the Service Module. The Columbus Module, ESA's principal contribution, is scheduled for a 2005 launch;
  - Canada's robotic arm was delivered to orbit in April of 2001; and
  - In addition, two of the three U.S.-owned, Italian-built Multi-Purpose Logistics Modules have been delivered and are making logistics flights to and from the ISS.
- Approximately 75 percent of all U.S. flight hardware has been delivered to Kennedy Space Center or deployed to orbit.

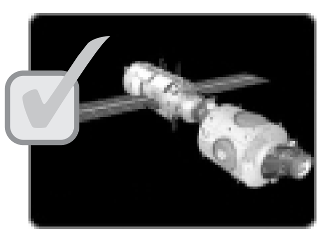
ISS Elements Launched to Date

- November 1998, ISS Mission 1A/R, the Zarya module was launched into orbit aboard a Russian Proton rocket.
- December 1998, ISS Mission 2A, STS-88 attached the Unity module and two Pressurized Mating Adapters to Zarya.
- July 2000, ISS Mission 1R, attached the Zvezda Service Module, delivered the Expedition One crew.
- October 2000, ISS Mission 3A, STS-92 attached the Z1 Truss, a third Pressurized Mating Adapter, Ku-band Communications System, and the Control Moment Gyros.
- October 2000, ISS Mission 1R, the initial three-person crew (Expedition One) was launched aboard a Russian Proton Rocket.
- November 2000, ISS Mission 4A, STS-97 attached the first set of U.S. solar arrays onto the Station, radiators, and the P6 Truss.
- February 2001, ISS Mission 5A, STS-98 attached the U.S. Destiny Laboratory Module.
- March 2001, ISS Mission 5A.1, STS-102 delivered the second resident crew and attached Leonardo, the first Multi-Purpose Logistics Module.
- April 2001, ISS Mission 6A, STS-100 launched Canada's Robot Arm.
- July 2001, ISS Mission 7A, STS-104 delivered the Joint Airlock, enabling spacewalks without the Space Shuttle present.

Illustrated Progress Overview (element launches only)

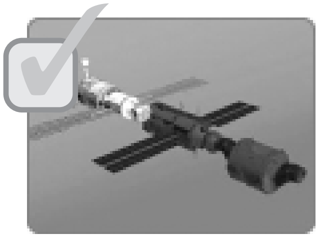


ISS Mission 1A/R (Proton)
Zarya Control Module (Functional Cargo Block)
November 1998

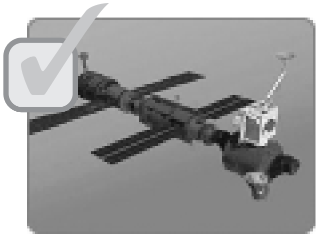


ISS Mission 2A (STS-88)
Unity Node (1 Stowage Rack)
December 1998

Shuttle Crew: Cmdr. Robert D. Cabana; Pilot Frederick W. "Rick" Sturckow; Mission Specialists James H. Newman, Nancy J. Currie, Ph.D., Jerry L. Ross, and Sergei Konstantinovich Krikalev (Russia).

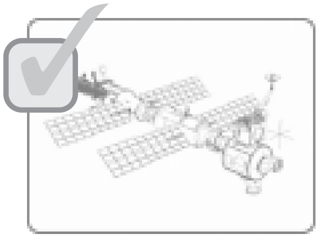


ISS Mission 1R (Proton)
Zvezda Service Module
July 2000



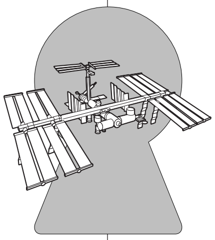
ISS Mission 3A (STS-92)
Truss Segments and Control Systems
October 2000

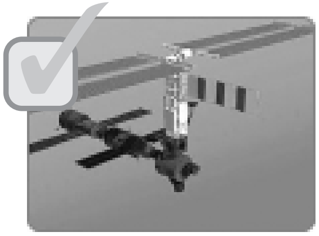
Shuttle Crew: Cmdr. Brian Duffy; Pilot Pam Melroy; Mission Specialists Leroy Chiao, Michael Lopez-Alegria, Bill McArthur, Jeff Wisoff, and Koichi Wakata (Japan).



ISS Mission 2R (Soyuz)
Test Flight and Assembly
October 2000

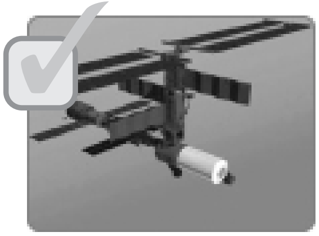
Expedition One Crew: Soyuz Cmdr./ISS Pilot Yuri Gidzenko; ISS Cmdr. Bill Shepherd; Sergei Krikalev.





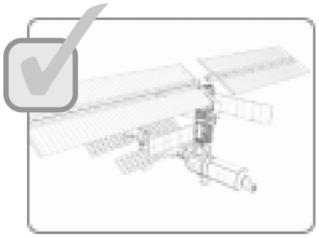
ISS Mission 4A (STS-97)
PV Arrays and Batteries
November 2000

Shuttle Crew: Cmdr. Brent Jett; Pilot Michael Bloomfield; Mission Specialists Joseph Tanner, Carlos Noriega, and Marc Garneau (Canada).



ISS Mission 5A (STS-98)
U.S. Destiny Laboratory Module
February 2001

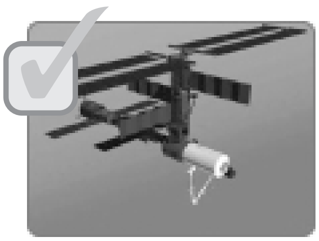
Shuttle Crew: Cmdr. Kenneth Cockrell; Pilot Mark Polansky; Mission Specialists Bob Curbeam, Thomas Jones, and Marsha Ivins.



ISS Mission 5A.1 (STS-102)
Crew Exchange/Leonardo MPLM Laboratory Equipment
February 2001

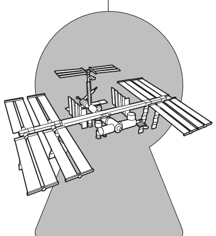
Shuttle Crew: Cmdr. James Weatherbee; Pilot James Kelly; Mission Specialists Andy Thomas and Paul Richards.

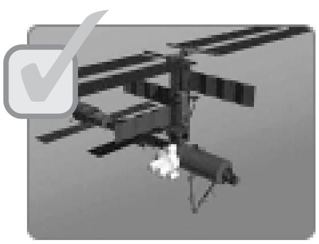
Expedition Two Crew: ISS Cmdr. Yury Usachev (Russia); James Voss; Susan Helms.



ISS Mission 6A (STS-100)
U.S. Lab Outfitting, UHF Antenna, Canada Arm
April 2001

Shuttle Crew: Cmdr. Kent V. Rominger; Pilot Jeffrey Ashby; Mission Specialists Chris Hadfield (Canada), John Phillips, Scott Parazynski, Umberto Guidoni (Italy), and Yuri Lonchakov (Russia).





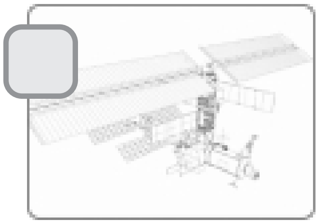
ISS Mission 7A (STS-104)
Joint Airlock, High Pressure Gas Assembly
July 2001

Shuttle Crew: Cmdr. Steven Lindsey; Pilot Charles Hobaugh; Mission Specialists Michael Gernhardt, James Reilly, and Janey Kavandi.

ISS mission designation includes sequence number and launching country. For example: ISS Mission 3A was the third ISS mission, and it was an American mission.

Launch vehicles used for each ISS mission are shown in parentheses. The term "STS" indicates a Space Shuttle mission. "STS" is an acronym for Space Transportation System.

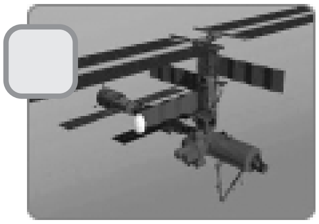
The Year Ahead



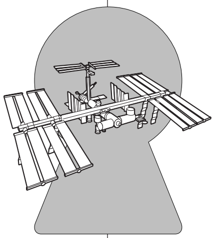
ISS Mission 7A.1 (STS-105)
Logistics and Resupply
August 2001

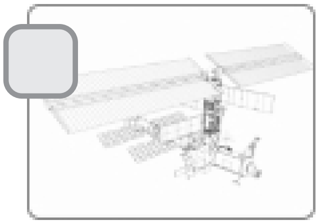
Shuttle Crew: Cmdr. Scott Horowitz; Pilot Rick Sturckow; Mission Specialists Daniel Barry and Patrick Forrester.

Expedition Three Crew: Cmdr. Frank Culbertson; Mikhail Turin (Russia); Valdimir Dezhurov (Russia).



ISS Mission 4R (Soyuz)
Russian Docking Ports, Strela Boom
August 2001

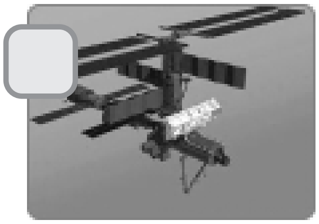




ISS Mission UF1 (STS-108)
Logistics and Utilization
November 2001

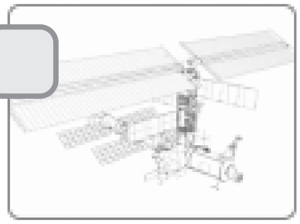
Shuttle Crew: Cmdr. Dominic L. Gorie; Pilot Mark E. Kelly; Mission Specialist Linda M. Godwin, and Daniel M. Tani.

Expedition Four Crew: Cmdr. Carl E. Walz; Yuri Onufrienko (Russia); Daniel W. Bursch.



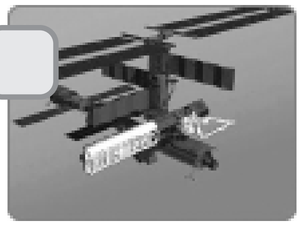
ISS Mission 8A (STS-110)
Central Truss Segment and Mobile Transporter
February 2002

Shuttle Crew: Cmdr. Michael Bloomfield, Pilot Stephen Frick, Mission Specialist Jerry Ross, Ellen Ochoa, Lee M.E. Morin, and Rex Walheim.



ISS Mission UF-2 (STS-111)
Multipurpose Logistics Module; Mobile Base System
April 2002

Shuttle Crew: TBD



ISS Mission 9A (STS-112)
First Right-side Truss Segment with Radiators;
Crew and Equipment Translation Aid Cart A
July 2002

Shuttle Crew: TBD

ISS Mission ULF-1 (STS-113)
Utilization and Logistics Flight, Spares Pallet
August 2002

Shuttle Crew: TBD

Current Funding Decisions

To address potential ISS Program cost increases and to ensure that the program remains within its 5-year budget plan, the current President's Fiscal Year 2002 Budget includes important decisions regarding the funding and management of the program with the goal of preserving the highest-priority goals:

- Permanent human presence in space
- World-class research in space
- Accommodation of international partner elements

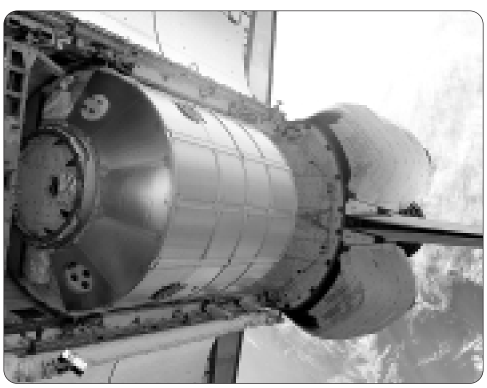
A "U.S. Core" ISS program is funded that provides the elements necessary to accept major international hardware elements:

- U.S. Core completion is achieved with deployment of Node 2 in February 2004.
- U.S. hardware elements not funded in U.S. Core include the Habitation module, the Crew Return Vehicle, and the Propulsion Module.
- ISS onorbit research plans are not significantly affected through 2004.
- Decisions to increase U.S. capabilities beyond U.S. Core depend on quality of the cost estimates, resolution of technical issues, and availability of funds.

Principal impacts of reducing the U.S. contribution to the ISS Program include the following:

- Reduced permanent crew to three, with potential of future growth
- Limited crew time available for research
- Life support and emergency crew return will be provided only by Russia

Resolution of major issues, including options to increase crew size and research, will be part of the Fiscal Year 2003 budget formulation process.



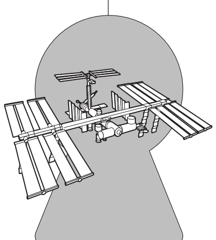
The Leonardo Multi-Purpose Logistics Module rests in *Discovery*'s payload bay in this view taken from the International Space Station by a crew member.

Astronaut Scott E. Parazynski talks with cosmonaut Yury V. Usachev, Expedition Two commander, who is conducting maintenance on the Treadmill Vibration Isolation System in the Zvezda/Service Module.

Research on the International Space Station

The ISS represents a quantum leap in our capability to conduct research on orbit. It will serve as a laboratory for exploring basic questions in a variety of disciplines, and as a testbed and springboard for exploration. Research on the ISS will include commercial, scientific, and engineering research in the following areas:

Early Research Disciplines:



Biomedical Research and Countermeasures: Researchers seek to understand and control the effects of the space environment on space travelers (e.g., muscle atrophy, bone loss, fluid shifts).

Long-term Benefits: Enhance the safety of space travel; develop methods to keep humans healthy in low-gravity environments; advance new fields of research in the treatment of diseases.

Fundamental Biology: Scientists study gravity's influence on the evolution, development, growth, and internal processes of plants and animals. Their results expand fundamental knowledge that will benefit medical, agricultural, and other industries.

Long-term Benefits: Advance understanding of cell, tissue, and animal behavior; use of plants as sources of food and oxygen for exploration; improved plants for agricultural and forestry.

Biotechnology: Current technology indicates that a weightless environment may enable researchers to grow three-dimensional tissues that have characteristics more similar to tissues in the body than has ever been previously available and to produce protein crystals for use in drug development.

Long-term Benefits: Culture realistic tissue for use in research (cancerous tumors, organ pieces); provide information to design a new class of drugs to target specific proteins and cure specific diseases.

Fluid Physics: The behavior of fluids is profoundly influenced by gravity. Researchers use gravity as an experimental variable to explain and model fluid behavior in systems on Earth and in space.

Long-term Benefits: Improved spacecraft systems designs for safety and efficiency; better understanding of soil behavior in Earthquake conditions; improved mathematical models for designing fluid handling systems for powerplants, refineries, and innumerable other industrial applications.

Later Research Disciplines:

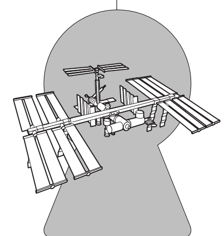
Advanced Human Support Technology: Researchers develop technologies, systems, and procedures to enable safe and efficient human exploration and development of space.

Long-term Benefits: Reduce the cost of space travel while enhancing safety; develop small, low-power monitoring and sensing technologies with applications in environmental monitoring in space and on Earth; develop advanced waste processing and agricultural technologies with applications in space and on Earth.

Materials Science: Researchers use low gravity to advance our understanding of the relationships among the structure, processing and properties of materials. In low gravity, differences in weight of liquids used to form materials do not interfere with the ability to mix these materials opening the door to a whole new world of composite materials.

Long-term Benefits: Advance understanding of processes for manufacturing semiconductors, collids, metals, ceramics, polymers, and other materials; determine fundamental physical properties of molten metal, semiconductors, and other materials with precision impossible on Earth.

Combustion Science: The reduction of gravity allows scientists to simplify the study of complex combustion (burning) processes. Since combustion is used to produce 85 percent of Earth's energy, even small improvements in efficiency and reduction of soot production (a major source of pollution on earth) will have large economic and environmental benefits.



Long-term Benefits: Enhance efficiency of combustion processes; enhance fire detection and safety on Earth and in space; improve control of combustion emissions and pollutants.

Fundamental Physics: Scientists use the low gravity and low temperature environment to slow down reactions allowing them to test fundamental theories of physics with degrees of accuracy that far exceed the capacity of Earthbound science.

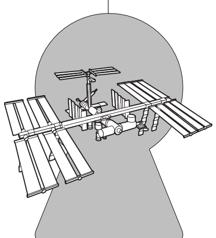
Long-term Benefits: Challenge and expand theories of how matter organizes as it changes state (important in understanding superconductivity); test fundamental theories in physics with precision beyond the capacity of Earth-bound science.

Earth Science and Space Science: Space Station will be a unique platform with multiple exterior attach points from which to observe the Earth and the universe.

Long-term Benefits: Space Scientists will use the location above the atmosphere to collect and search for cosmic rays, cosmic dust, anti-matter and "dark" matter. Earth scientists can obtain global profiles of aerosols, ozone, water vapor, and oxides in order to determine their role in climatological processes and take advantage of the longevity of ISS to observe global changes over many years.

For the latest information on the International Space Station, go to:

http://spaceflight.nasa.gov

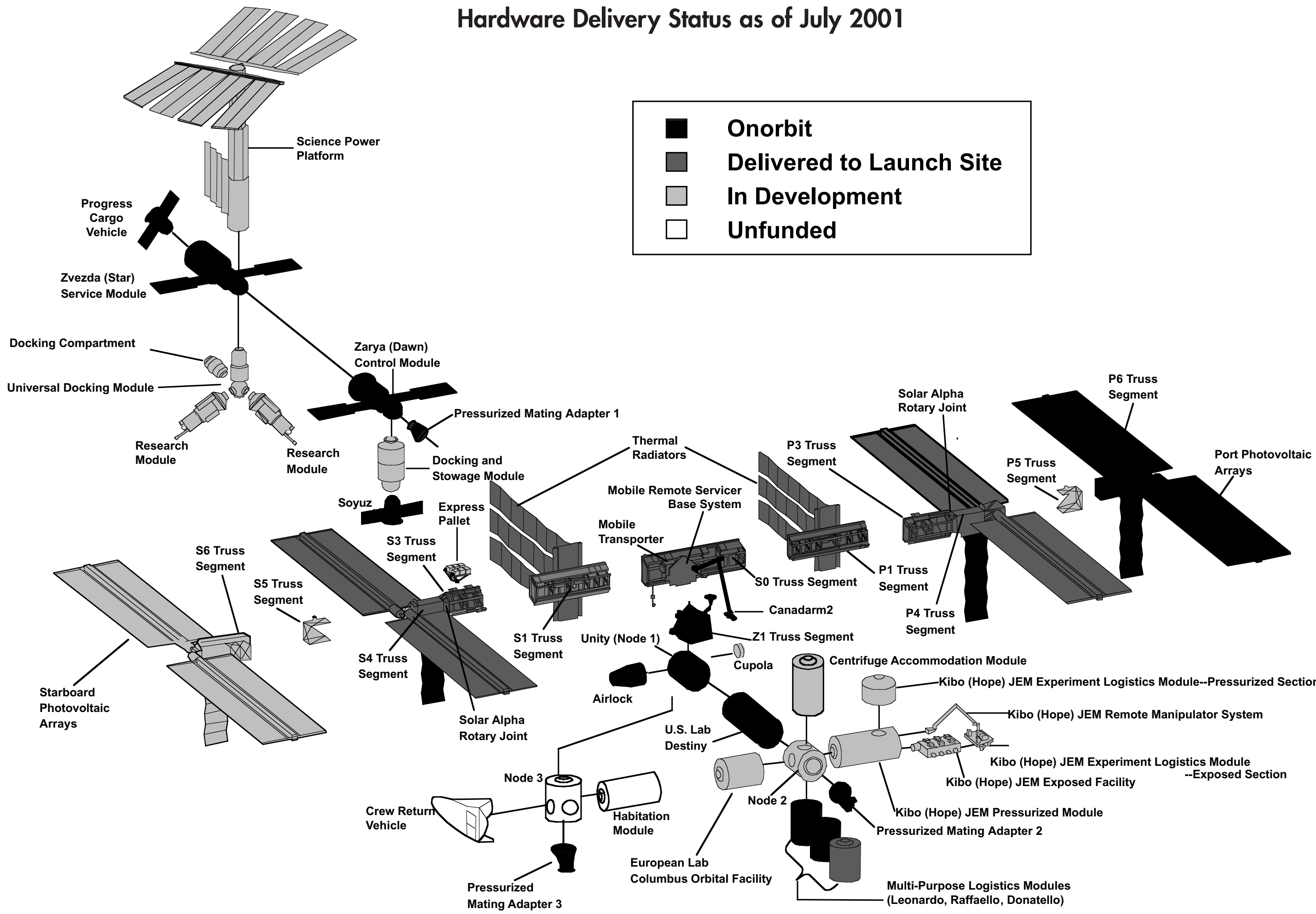


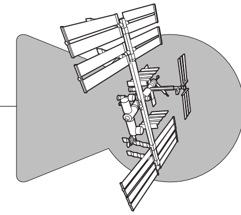
NASA's space flight Web site brings your the most up-to-the-minute information available on the International Space Station, including:

- Sighting information
- Realtime data
- Shuttle mission
- Assembly status
- The latest images
- Live video of life and work in orbit
- Live docking video
- Crew information and training
- News and interviews
- Time onorbit
- Scientific findings

International Space Station Assembly

Hardware Delivery Status as of July 2001





Proposed Assembly Sequence as of July 2001

(Supports President's Proposed Fiscal Year 2002 Budget)

Calendar Year	1998	1999	2000	2001	2002	2003	2004 and beyond
Launch Summary	2	1	6	7	5	6	Flights beyond the U.S. Core completion are currently under review.
Shuttle Launches*	**1**	**1**	**4**	**6**	**7**	**5**	
Assembly	(1)	(1)	(4)	(5)	(3)	(5)	
Utilization	(0)	(0)	(0)	(1)	(2)	(0)	
Russian Assmebly Launches	**1**	**0**	**2**	**1**	**0**	**1**	

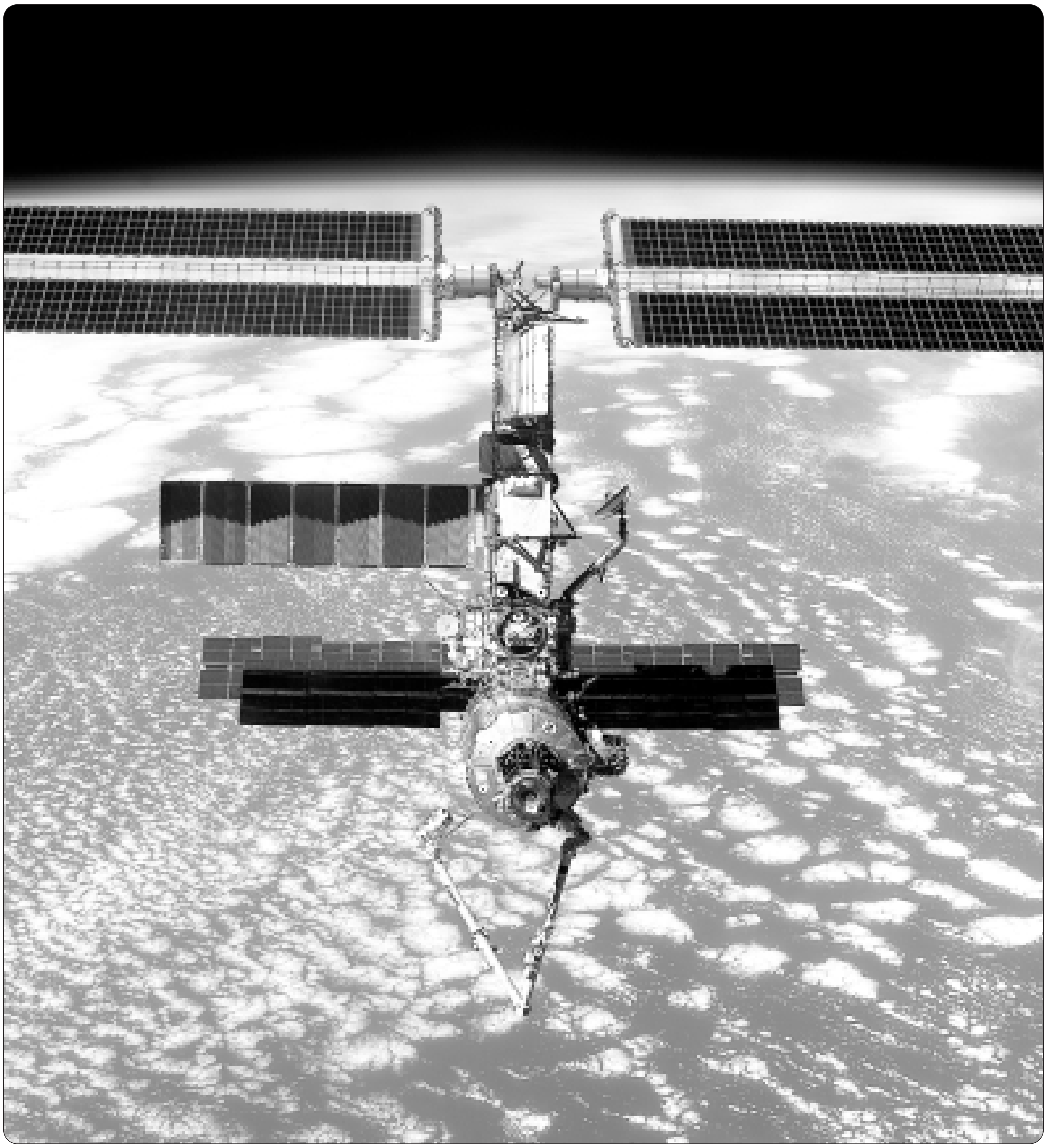
Major Milestones

COMPLETED

"Zarya" (FGB) *1st element launch*	11/98
"Unity" (Node1) *1st U.S. element launch*	12/98
"Zvezda" Service Module	7/00
Soyuz 3-Person Permanent	10/00
U.S. "Destiny" Lab launch	1/01
Canadian Robotic Arm launch	4/01
Utilization Flights	11/01, 4/02, 8/02
U.S. Core Complete**	2/04
Japanese Kibo launch	
ESA Laboratory launch	
U.S. Hab Module launch	CURRENTLY NOT FUNDED
7-Person Crew Capablity	CURRENTLY NOT FUNDED

* Shuttle launches of partner elements are included in U.S. assembly line (Japan's Kibo, ESA's COF, Canadian SSRMS, Russian SPP).

** The U.S. Core provides those elements necessary to accept major international hardware elements.



Backdropped against the blue and white Earth and sporting a readily visible new Canadian Robotic Arm, the International Space Station (ISS) was photographed following separation from the Space Shuttle *Endeavour*.